a 15
End

417, 418 being positively biased attract the negative ions into the central flow path 26 of filter 420, while positive ions are neutralized on electrode 419.

Amendments to the specification are indicated in the attached "Marked Up Version of Amendments" (pages i –vii).

In the Claims

Please cancel Claims 34 and 43.

Please amend Claims 1-9, 12, 15, 17, 18, 21, 22, 24, 28, 30, 31, 33, 35, 38, 40, 44-48, 53-55, 57, 62, 67-76, 78, 82, 84-90, 92, 93, 97-114, 116, and 118. Amendments to the claims are indicated in the attached "Marked Up Version of Amendments" (pages viii-xix).

a 16

1. (Amended) An asymmetric field ion mobility apparatus for identification of ion species, the apparatus comprising:

an ion filter associated with a flow path, said flow path having a longitudinal axis for the flow of ions, said filter supplying an asymmetric filter field transverse to said longitudinal axis, said filter field being compensated;

an ion flow part for longitudinally propelling ions along said flow path, said ion flow part propelling said ions via a propulsion field, said propelled ions flowing in said filter; and

said ion filter selecting a species of said propelled ions flowing in said filter, said species having at least one characteristic correlated with said compensated asymmetric filter field, said correlation facilitating identification of said species.

2. (Amended) Apparatus of claim 1 further comprising:

an ion source and a detection region, the ion flow part providing a flow of said ions flowing in the filter from the ion source in a longitudinal direction toward the detection region said selected species.

A16 Cont'd

3. (Amended) Apparatus of claim 1 wherein the asymmetric field is compensated to prefer a species of the ions to be passed through the filter by the flow part.

4. (Amended) Apparatus of claim 2 further comprising a detector in said detection region, said detector generating a detection signal representative of said ion species passed by the filter.

5. (Amended) Apparatus of claim 1 wherein said ion flow part further comprises an electric propulsion field for providing said propelling.

6. (Amended) Apparatus of claim 5 wherein said propulsion field is a longitudinal electric field and wherein a control part includes an intelligent electronic controller, including a microprocessor, for controlling said compensated asymmetric field and said longitudinal field and for correlating said controlling with a detection signal.

7. (Amended) Apparatus of claim 6 wherein the control part includes an intelligent electronic controller, including a microprocessor and lookup table, for controlling said compensated asymmetric field and said longitudinal propulsion with control signals and for correlating said control signals with said detection signal and said lookup table, for identifying said detected ion species.

8. (Amended) Apparatus of claim 2 wherein the ion filter includes at least a pair of electrodes facing each other over the flow path having connection for an electric controller, said controller for applying a compensated asymmetric periodic voltage to said filter electrodes.

9. (Amended) Apparatus of claim 1 wherein the ion filter includes a plurality of electrodes facing each other over the flow path and having pads for connection to an electric controller, members of the plurality being used to create said filter field and a longitudinal propulsion field.

A17

12. (Amended) Apparatus of claim 2 wherein one or more sets of electrodes are used to create said filter field for ion discrimination and the ion flow part uses one or more of said

19 3rd

electrodes to create an electric field at some angle to said filter field for propelling said ions through said filtering field.

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15. (Amended) Apparatus of claim 2 wherein said ion flow part provides a longitudinal electric field transport to said ions in said filter.

17. (Amended) Apparatus of claim 16 wherein said longitudinal electric field is either constant or varying in time or space, and may be pulsed.

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18. (Amended) Apparatus of claim 2 wherein said ion flow part further comprises discrete electrodes supported by and insulated from said filter electrodes by an insulating medium.

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21. (Amended) Apparatus of claim 1 further having an ion source and a detector region, a plurality of electrodes forming said ion flow part and being used to create a propulsion field which flows ions in a longitudinal direction away from said ion source toward said detector region .

22. (Amended) Apparatus of claim 21 wherein said plurality of electrodes defines first and second sets of electrodes, said sets facing each other across said flow path, a respective longitudinal electric field being established between the electrodes of each set, each said respective longitudinal field having a longitudinal flow direction along said flow path toward said detector region.

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24. (Amended) Apparatus of claim 23 wherein said first and second sets of electrodes each include a first bias electrode and a second bias electrode for application of a dc bias thereto, the first of said bias electrodes in each said set being biased relatively more than the second of said bias electrodes of each said set.

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28. (Amended) Apparatus of claim 12 wherein said filter electrodes are interspersed with said ion flow part electrodes.

30. (Amended) Apparatus of claim 21 wherein said ion filter and said ion flow part share common longitudinal space along said flow path.

31. (Amended) Apparatus of claim 1 wherein said ion flow is from an ion source downstream along said flow path toward a detector, wherein said filter operates without a gas flow through it in said downstream direction.

33. (Amended) Apparatus of claim 32 wherein said reverse gas flow includes a supply of clean filtered gas for cleansing of said ion filter.

35 (Amended) Apparatus of claim 1 wherein said ion flow part includes spaced discrete electrodes along the flow path.

38. (Amended) Apparatus of claim 37 wherein said ion flow part electrodes are formed over said insulation layer.

40. (Amended) Apparatus of claim 9 wherein said ions flow from an ionization region and are propelled in a low volume flow along the direction of said flow path longitudinal axis by an electric field.

44. (Amended) Apparatus of claim 42 wherein said electrodes are coated with a thin insulator and a resistive layer and propulsion electrodes are formed on said resistive layer for generation of said longitudinal electric field therebetween.

45. (Amended) Apparatus of claim 44 wherein said propulsion electrodes make contact with said resistive layer to enable a voltage drop that generates said longitudinal electric field.

46. (Amended) Apparatus of claim 9 wherein said flow path defines a gap between said filter electrodes, further including a second flow path, said first and second flow paths joined by a passageway, further having a source for a sample-carrying gas, said second flow path for receipt of sample-carrying gas, ions in said sample-carrying gas being flowed into said second flow path via said passageway.

A 28 End

47. (Amended) Apparatus of claim 46 further comprising deflection electrodes for deflection of said ions into said first flow path, said ions flowed into said gap by said ion flow part.

48. (Amended) Apparatus of claim 47 wherein said ion flow part propels said ions through said asymmetric filter field.

A 29

53. (Amended) Apparatus of claim 52 wherein ones of said electrodes receive DC compensation from said controller for said compensation of said filter field.

54. (Amended) Apparatus of claim 52 further including a plurality of electrodes for generation of an ion propelling electric field by said ion flow part.

55. (Amended) Apparatus of claim 54 wherein said high frequency electrodes and the longitudinal field producing electrodes have a potential developed across them.

A 30

57. (Amended) Apparatus of claim 1 further including a plurality of filter electrodes connectable to an electric controller for application of an asymmetric periodic voltage to create said filter field, further including a plurality of electrodes for generation of an ion propelling electric field by said ion flow part, wherein said high frequency electrodes are drivable while or interspersed with driving the longitudinal field producing electrodes.

A 31

62. (Amended) Apparatus of claim 54 wherein an electrical field presence is generated by driving several of said electrodes, said field presence having both transverse and longitudinal components to both filter and propel the ions, wherein an RF signal is applied to the electrodes to generate a transverse RF filter field, which is compensated, and said ion flow part includes a selection of said electrodes biased to different voltage levels to generate a gradient along the flow path.

A 32

67. (Amended) Apparatus of claim 1 further including an ionization source for ionization of a sample to generate ions to be flowed by said ion flow part.

A3 Cont'd

68. (Amended) Apparatus of claim 67 wherein the ionization source is selected from the group including a radiation source, an ultraviolet lamp, a corona discharge device, a plasma source or an electrospray nozzle.

69. (Amended) An asymmetric field ion mobility spectrometer apparatus comprising:

a flow path for the flow of ions in a longitudinal direction from an ionization region toward a detector region;

an ion filter disposed in the flow path downstream from the ionization region, the ion filter disposed in the flow path and supplying an asymmetric field transverse to the flow path;

an ion flow device for creating a longitudinal transport field for propelling ions in the filter longitudinally along the flow path;

the asymmetric field transverse to the ion flow in the flow path; and

the ion filter passing ions toward the detector region as influenced by the transverse asymmetric field and as propelled by the longitudinal transport field.

70. (Amended) Apparatus of claim 69 in which the ion filter is connected to an electric controller for applying an asymmetric periodic voltage to the ion filter, and wherein said ion filter includes a pair of spaced electrodes for creating a compensated asymmetric electric field and the ion flow device includes a plurality of spaced electrodes for creating the longitudinal field.

71. (Amended) Apparatus of claim 70 in which the ion filter includes a first plurality of discrete electrodes electrically connected to an electric controller which applies an asymmetric periodic voltage to the first plurality of discrete electrodes and in which the ion flow device includes a second plurality of discrete electrodes dispersed among the first plurality of discrete electrodes connected to a voltage source which generates a potential gradient along the second plurality of discrete electrodes creating a preferential ion flow direction in said flow path.

72. (Amended) Apparatus of claim 71 in which the gap between the filter electrodes is enclosed by a housing, said ion filter includes electrodes on a surface of the housing and the ion flow device includes electrodes proximate to the ion filter.

A32 End

73. (Amended) Apparatus of claim 72 in which the ion detector includes electrodes on an inside surface of the housing proximate the ion filter and the ion flow device.

74. (Amended) Apparatus of claim 72 in which the gap is enclosed by a housing, the ion filter includes electrodes on an outside surface of the housing and the ion flow device includes resistive layers on an inside surface of the housing and a voltage is applied along each layer to create a longitudinal electric field.

75. (Amended) Apparatus of claim 69 wherein the ion filter and the ion flow device are combined and include a series of discrete conductive elements each excited by a voltage source at a different phase.

76. (Amended) Apparatus of claim 69 wherein the ion filter and the ion flow device include a series of electrodes in said flow path each excited by a voltage source, electrodes associated with said flow device having a multiphase signal applied thereto for generation of said longitudinal transport field.

A33

78. (Amended) Apparatus of claim 77 further comprising a controller for selectively applying a bias voltage and an asymmetric periodic voltage across the filter electrodes to control the path of ions through the filter under influence of said ion flow device, and an output region for delivery of ions passed by said filter for detection.

A34

82. (Amended) Method for analysis of chemicals in a sample, comprising the steps of:

placing an ion filter in a flow path, said flow path having a longitudinal axis for the flow of ions,

driving said filter to create an asymmetric filter field transverse in said flow path to said longitudinal axis,

R.34 End

forming an ion flow field in said flow path in cooperation with said asymmetric filter field,

driving said ion flow field for longitudinally propelling said ions along said flow path in said asymmetric filter field; and

compensating said asymmetric filter field for passing a selected species of said propelled ions, said species having at least one characteristic correlated with said compensation, said correlation facilitating identification of said species.

84. (Amended) Method of claim 83 further comprising the steps of:

providing an intelligent electronic controller, including a microprocessor, for controlling said compensated asymmetric field and said ion flow field and for correlating said control with said detection.

R.35

85. (Amended) Method of claim 83 further comprising the steps of:

providing an intelligent electronic controller, including a microprocessor and lookup table, for controlling said compensated asymmetric field and said ion flow field with control signals and for correlating said control signals with said detection signal and said lookup table, for identifying said detected ion species.

86. (Amended) Method of claim 83 wherein the ion filter includes at least a pair of electrodes facing each other over the flow path having connection for an electric controller, said controller for applying a compensated asymmetric periodic voltage to said filter electrodes.

87. (Amended) Method of claim 86 wherein the ion filter includes a plurality of electrodes facing each other over the flow path and having pads for connection to an electric controller, members of the plurality being used to create said asymmetric filter field and said ion flow field.

A 35 Fnd

88. (Amended) Method of claim 87 wherein said members create said asymmetric filter field and said ion flow field simultaneously.

89. (Amended) Method of claim 87 wherein said members create said asymmetric filter field and said ion flow field simultaneously using different members of said plurality.

90. (Amended) Method of claim 87 wherein one or more sets of electrodes are used to create a filtering electric field for ion discrimination and the ion flow field is generated using the same or a second set of electrodes to create an electric field at some angle to said asymmetric filter field for propelling said ions through said asymmetric filtering field.

A 36

92. (Amended) Method of claim 82 wherein said compensating further comprising the step of application of compensation to said filter to pass ions forming said species sharing a common set of characteristics, said ion flow field propelling ions through said asymmetric filter field according to said characteristics and said applied compensation.

93. (Amended) Method of claim 82 further comprising the step of providing a longitudinal electric field that is either constant or varying in time or space to provide said propulsion.

A 37

97. (Amended) Method of claim 82 further including the step of providing an ion source and a detector region, a plurality of electrodes forming said ion flow field which flows ions in a longitudinal direction away from said ion source toward said detector region in said flow path.

98. (Amended) Method of claim 82 further including the step wherein said plurality of electrodes defines first and second sets of electrodes, said sets facing each other across said flow path, a longitudinal electric field being established between the electrodes of each set, each longitudinal field having a longitudinal flow direction along said flow path toward said detector region.

99. (Amended) Method of claim 98 further including the step wherein said longitudinal fields are essentially equal.

A37 Cont'd

100. (Amended) Method of claim 99 further including the step wherein said first and second sets of electrodes each include a first bias electrode and a second bias electrode for application of a dc bias thereto, the first of said bias electrodes in each said set being biased relatively more than the second of said bias electrodes of each said set.

101. (Amended) Method of claim 100 further including the step of providing an ion concentrating device, said device urging said ions toward the center of said flow path as they flow downstream in said filter.

102. (Amended) Method of claim 101 further including the step wherein said concentrating device includes said pairs of biased electrodes, wherein said propelled ions are driven toward the center of said flow path as they flow downstream down the center of said flow path.

103. (Amended) Method of claim 82 further including the step wherein the ion filter is operated without a carrier gas flowing therethrough.

104. (Amended) Method of claim 82 further including the step wherein said filter operates with a reverse gas flow through it.

105. (Amended) Method of claim 82 further including the step of providing a housing, said housing defining said flow path.

106. (Amended) Method of claim 105 further including the step of providing a plurality of filter and propulsion electrodes, wherein said housing is defined by cooperating substrates on which said electrodes are formed.

107. (Amended) Method of claim 106 further including the step wherein said electrodes include a plurality of high frequency, high voltage filter electrodes connected to an electric controller for application of an asymmetric periodic voltage to create said filter field.

108. (Amended) Method of claim 107 further including the step wherein ones of said electrodes receive DC compensation from said controller.

109. (Amended) Method of claim 82 further including the step of providing a plurality of electrodes for generation of an ion propelling electric field by said ion flow part.

A31 cont'd

110. (Amended) Method of claim 82 further including the step of generating an electrical field presence by driving several of said electrodes, said field presence having both transverse and longitudinal components to both filter and propel the ions, by application of a traveling wave voltage.

111. (Amended) Method of claim 82 further including the step of providing an electrical field presence by driving several of said electrodes, said field presence having both transverse and longitudinal components to both filter and propel the ions, wherein an RF signal is applied to the electrodes to generate a transverse RF filter field, which is compensated, and said ion flow part includes a selection of said electrodes biased to different voltage levels to generate a gradient along the flow path.

112. (Amended) Method of claim 82 further including the step of providing a molecular sieve located proximate to said filter to absorb neutral molecules.

113. (Amended) An asymmetric field ion mobility apparatus for identification of ion species, the apparatus comprising:

an ion filter disposed in a flow path, said flow path having a longitudinal axis for the flow of ions, said filter supplying an asymmetric filter field transverse to said longitudinal axis;

an ion flow part for longitudinally propelling ions along said flow path in said asymmetric filter field; and

the ion filter passing a species of said propelled ions, said species having a set of correlated characteristics, said correlation facilitating identification of said species, said species being identified by trajectory.

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114. (Amended) Apparatus of claim 113 wherein said species are propelled in said trajectory in said filter, each said ion species having a set of characteristics correlated with said trajectory, said correlation facilitating identification of said species.

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116. (Amended) Apparatus of claim 115 further comprising first and second substrates, said flow path defined by said substrates, wherein an RF filter electrode is associated with said first substrate and a plurality of multi-function electrodes is associated with said second substrate and facing the filter electrode over the flow path.

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118. (Amended) Apparatus of claim 117 wherein said ions are propelled by the ion flow part, wherein said detector electrodes are monitored such that a particular species can be identified based on its trajectory for a given detection at said monitored detector electrodes and based on the fields in said flow path.

Please add new Claims 119 through 127.

40
119. (New) An asymmetric field ion mobility spectrometer comprising:

an ionization source for ionizing a sample media and creating ions;

an analytical gap;

an ion filter disposed in the analytical gap downstream from the ionization source for creating an asymmetric electric field to filter the ions;

an ion flow generator for creating an electric field transverse to the asymmetric electric field for propelling ions through the asymmetric electric field; and

an ion detector for sensing ions not filtered by the ion filter.

120. (New) The spectrometer of claim 119 where the asymmetric electric field is compensated to pass selected ions through the filter, the ion detector sensing the propelled ions that pass through the ion filter.

121. (New) The spectrometer of claim 119 further comprising a plurality of electrodes that perform said filtering and said propelling.

p 40 End

122. (New) The spectrometer of claim 119 wherein the ion filter includes a pair of spaced filter electrodes for creating the asymmetric electric field and the ion flow generator includes a plurality of spaced discrete electrodes insulated from the pair of spaced filter electrodes for creating the ion flow generator electric field.

123. (New) The spectrometer of claim 119 wherein the analytical gap is enclosed by a housing, the ion filter includes electrodes on an inside surface of the housing, and the ion flow generator includes electrodes proximate but insulated with respect to the filter electrodes.

124. (New) The apparatus of claim 1 further comprising a coupling part for coupling said flow path to a chromatographic sample preparation device for delivery of a prepared sample to said flow path.

125. (New) The apparatus of claim 69 further comprising a coupling part for coupling said flow path to a chromatographic sample preparation device for delivery of a prepared sample to said flow path.

126. (New) The apparatus of claim 113 further comprising a coupling part for coupling said flow path to a chromatographic sample preparation device for delivery of a prepared sample to said flow path.

127. (New) The spectrometer of claim 119 further comprising a coupling part for coupling said flow path to a chromatographic sample preparation device for delivery of a prepared sample to said flow path.

REMARKS

Entry of this Preliminary Amendment is respectfully requested.